

TABLE I

Nitridation Process	[N] Profile	Explanation of the profile	Comments
NO or NO + O <sub>2</sub> Mixture Growth		N incorporated throughout the film	Poor device performance due to high [N] at the substrate interface
N <sub>2</sub> O Anneal		N close to Si/SiO <sub>2</sub> interface	[N] Content insufficient to block Boron or reduce leakage in 0.1 μm devices
NO Anneal		N at the Si/SiO <sub>2</sub> interface	[N] higher than N <sub>2</sub> O anneal. Traps B inside SiO <sub>2</sub> . Poor interfacial properties and not significant reduction in leakage current
NH <sub>3</sub> Anneal (High Pressure ≥ 100 Torr)		Bimodal [N] distribution. N at the surface & substrate interface	[N] higher than NO anneal. N at surface traps boron. Poor interfacial properties.
Plasma Nitridation		High [N] at the poly/oxide interface	[N] at the surface blocks the Boron. Drive current degrades for ultra-thin dielectrics (< 10 Å)
NH <sub>3</sub> Anneal (Low Pressure ≤ 10 Torr)		Ideal profile. High [N] at the poly/oxide interface	High Drive current than plasma nitridation. Allows EOT scaling < 11 Å.

FIG. 1

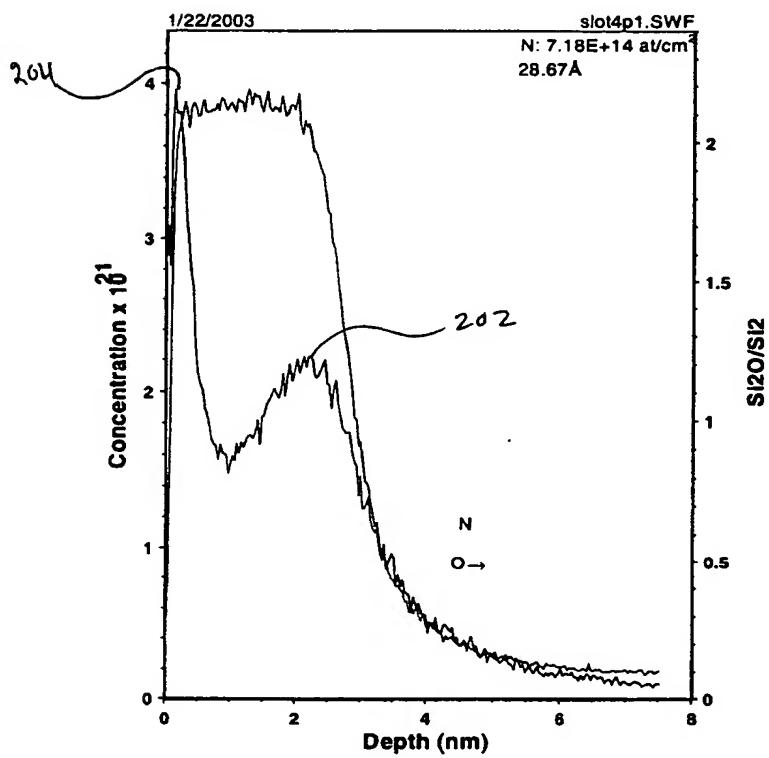
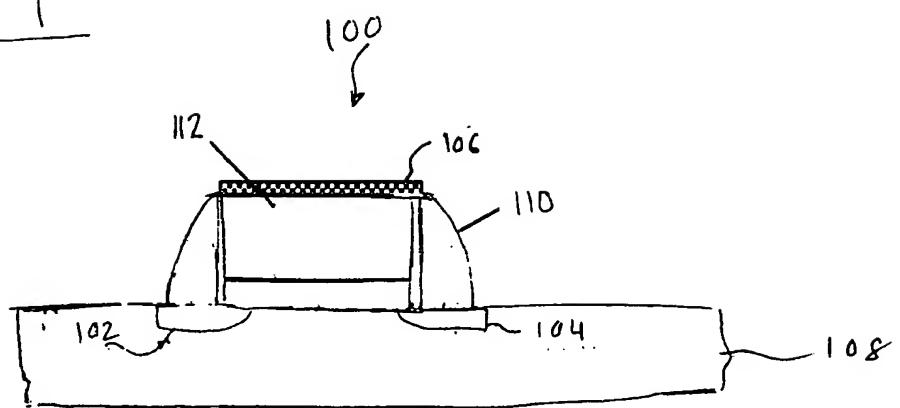


FIG. 2

FIG 3 A

**100 Torr**

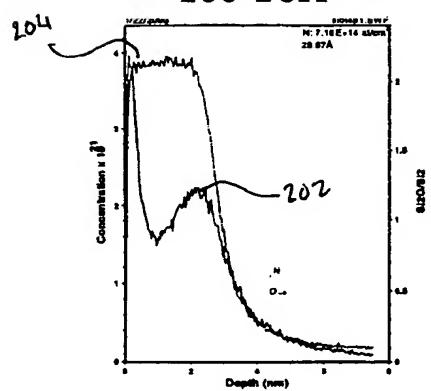


FIG 3 B

**10 Torr**

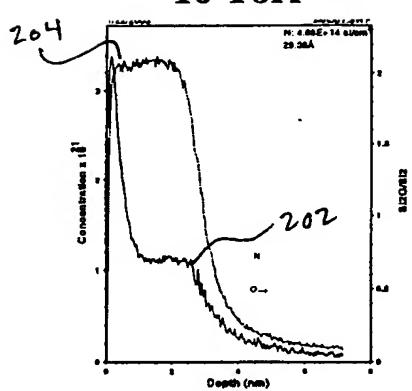


FIG 3 C

**1 Torr**

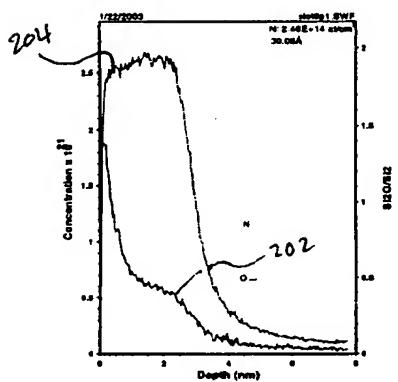


FIG 3 D

**0.625 Torr**

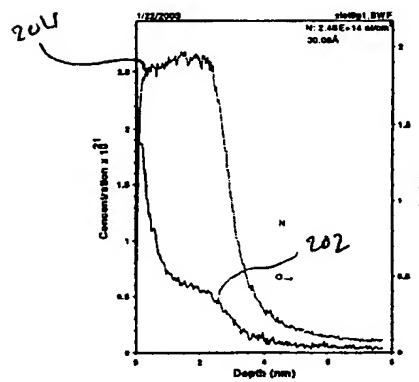


FIG 3 E

**0.25 Torr**

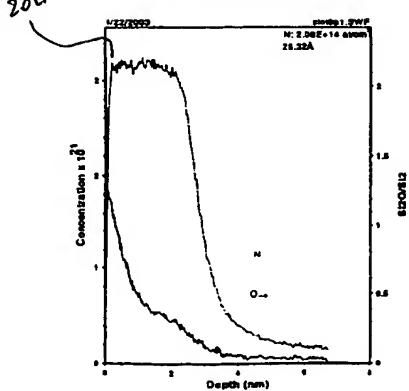


Fig. 4 A 1000 C; 100 Torr

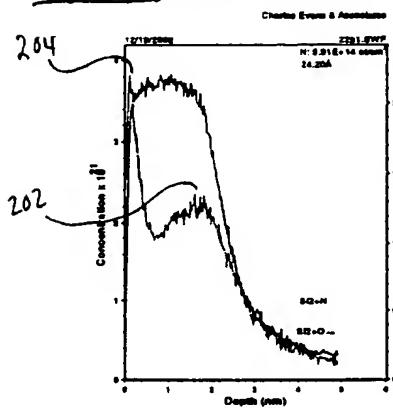


Fig. 4 B 1050 C; 55 Torr

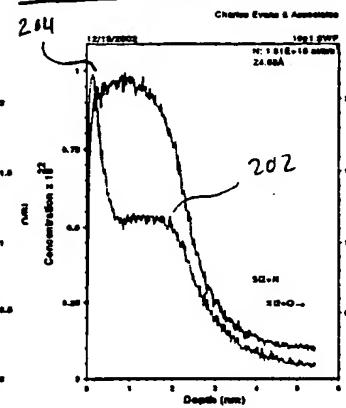


Fig. 4 C 1100 C; 10 Torr

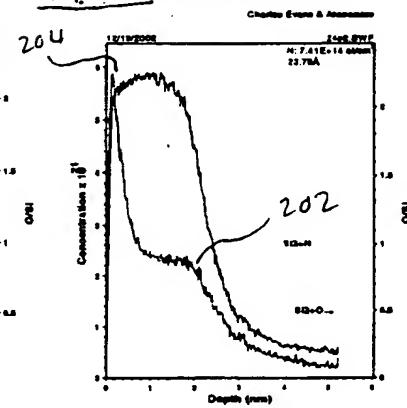


Fig 5 A RTO + DPN

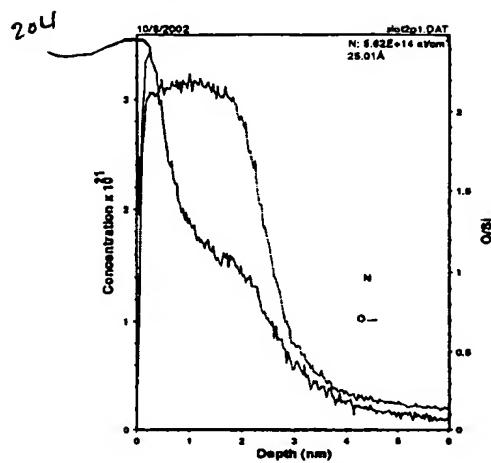


Fig 5 B RTO+100Torr RTA-NH<sub>3</sub>

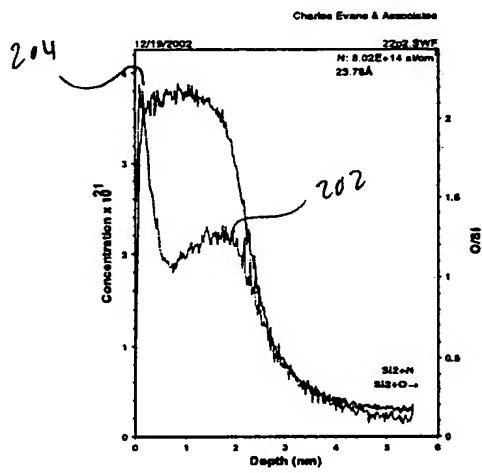
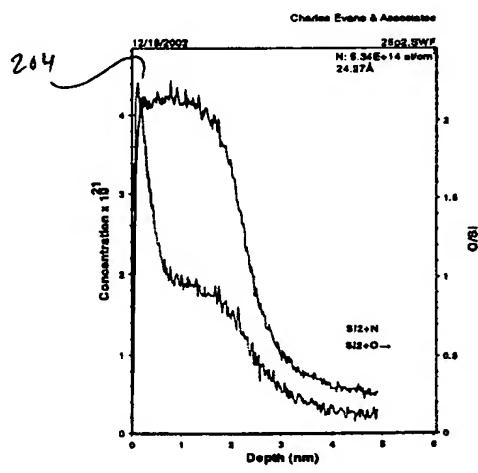


Fig 5 C RTO+10Torr RTA-NH<sub>3</sub>



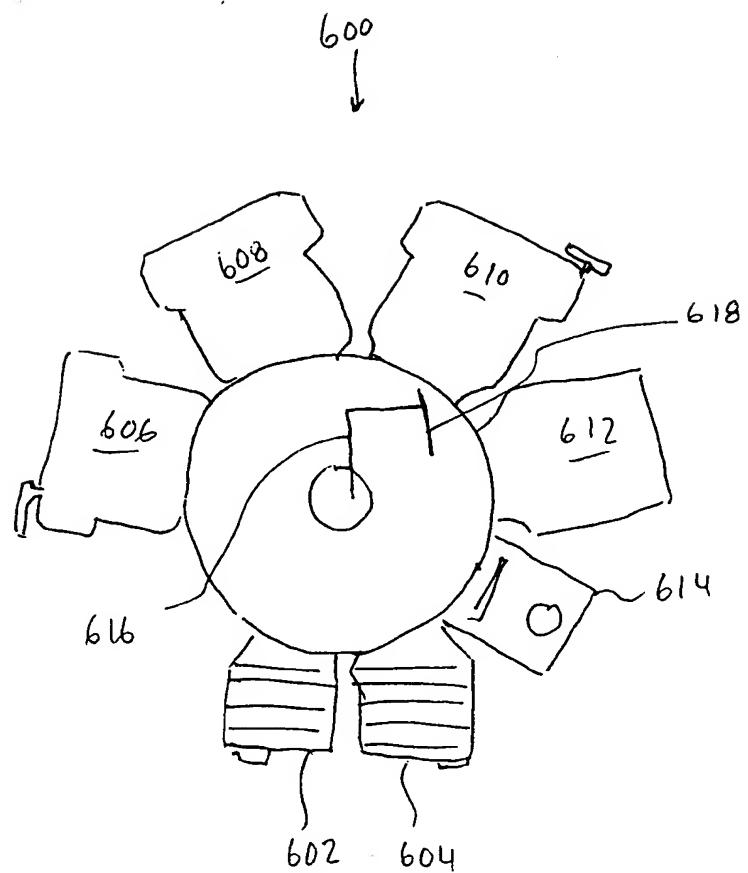


FIG. 6